

SILVICULTURAL GUIDELINES

Silviculture in the Central Hardwood Region is less refined than other regions. This is probably due to complexity of the species mix, the variety of site situations, and the inconsistent results with some methods. The Indiana State Forest system will primarily be managed under an uneven-aged system. There are several reasons for this.

Uneven-age systems provide for some of the other benefits that state forests provide to users. Aesthetically the relatively unbroken canopies maintain their appeal and visual continuity. Human management intervention appears less severe than under even-age systems. The continuous canopy cover benefits some wildlife species that are area sensitive. Even-age systems that allow high levels of sunlight to reach the ground offer a distinct advantage over uneven-age systems in the maintenance of some species or community types in the Central Hardwoods.

The basic administrative management unit on state forests is the tract. The tract is the unit silvicultural decisions are based on. The only exception to this may be the blocks of planted pine that may occur within tracts. These pine are often treated separately from the remainder of the tract. When treated separately, these blocks of pine can be considered a separate management unit.

Prior to management activities in tracts, the goals and activities for the tracts must be explained in the management guides. Guidance for management activities is the desired future condition of the tracts and the benefits provided.

State forest timber management should create a forested condition that is healthy and vigorous without fiber production being an overriding consideration. The forests should have a natural rather than planted look. There should be varied species composition, forest structure, and tree size to provide habitat diversity and aesthetic integrity within a contiguous-canopy forest context.

Hardwood Management

Hardwoods on Indiana's state forests will primarily be managed under the uneven-age system. This does not preclude the occasional use of an even-age method to regenerate an area, with Central Office staff approval. The desired target should eventually generally be an uneven-age tract.

The goal of our hardwood management is to produce healthy, vigorous forests of mixed species composition with quality forestland conditions providing a diversity of habitat conditions

within the forested context. While there is significant focus on high value timber species, it should be remembered that the species composition is less important than overall quality and vigor. It is acceptable and, on some sites, desirable to actively manage quality stems of species traditionally considered less desirable such as beech, hickory, or sugar maple. It is desirable to grow some individuals to a very large size and very old age for aesthetic benefits.

Regeneration methods under the uneven-age system are single tree selection and group selection. Single tree selection is where the removal of a single, large crowned tree will create sufficient space for regeneration to be established and develop. Single tree selection is generally only successful in the regeneration of shade tolerant species. Group selection is when a group of trees is removed to create sufficient space for regeneration establishment and development. Group selection is useful in the regeneration of intermediate and shade intolerant species.

To limit the visual impact, individual group selection openings on state forests can be no larger than five acres in size without prior Central Office staff specialist approval. Group selection openings should be at least a quarter acre in size on south-facing slopes, and one-half acre in size on north-facing slopes. The minimum size of east and west slope group selection openings will be about one-third acre. Openings smaller than these minimum sizes should be considered canopy holes rather than group selection openings. This is because the small canopy holes will generally not support establishment and development of shade intolerant regeneration on a large scale. These canopy holes are closer to single tree selection gaps because they do not produce significantly altered environmental conditions that openings should create. Identification and layout of a group selection opening should consider the alignment of the site with the predominant sun angle. Openings with the widest dimension aligned toward the sun receive more light than those with the narrowest dimension aligned toward the sun.

The decision that a portion of a tract requires a group selection is based on the composition or condition of the existing trees, the goals for the tract, and the likely result of the opening. Group selection openings will generally be a group of trees that: 1) have received significant damage in the past resulting in defective, decaying stems; 2) have poor vigor, either from maturity or damage; and/or 3) are generally mature with reduced vigor and little desirable regeneration present or possible without a significant increase in sunlight to the forest floor. Groups of trees that may be less desirable timber species, but generally have quality and vigor should not be targeted for openings simply because of species composition. Forest health and vigor are of more importance than species composition.

Over a very long period of time, depending on conditions, some parts of any one tract may receive multiple group selection openings. Other parts of the same tract may never receive a group selection opening. The criteria are based on the condition of the trees and the desired condition of the tract, not a set rotation.

State forests will track the age and future management for one cutting cycle of all group selection openings. Between the ages of 8 and 12 years, all group selection openings will be evaluated for follow-up TSI. This TSI will release oak, walnut and other croptrees that are viable for reaching the main canopy. The TSI may also help other desired trees. If oak is the primary species to be released and is adequately distributed in the opening, prescribed fire can be used for release.

Intermediate cuttings are treatments designed to assist the development of the existing trees, but not designed to establish new trees. Intermediate cuttings can involve commercial harvesting or precommercial timber stand improvement operations.

One intermediate cutting that is often used is the improvement cutting. This retains the more desirable trees while removing defective or poor quality trees.

Thinning is another intermediate cutting. This is used in even-age or even-size groups of trees to reduce density. There are several different thinning methods commonly used. Low thinning, or thinning from below, removes the trees most likely to drop out from competition - those in the suppressed and intermediate crown classes. Selection thinning involves the removal of trees in the dominant, and occasionally codominant classes to release the desirable trees in the lower crown classes. Geometric thinning is the removal of trees in some predetermined physical pattern and is most often used with plantings and plantations. Free thinning is the combination of more than one thinning method.

Typical state forest timber harvest and timber stand improvement operations involve a combination of the regeneration and intermediate methods on the same tract. Single tree selection, group selection, improvement cutting, and thinning are usually done in the same operation.

The choice on what treatments to employ in a tract, and how to employ them depend on the condition of the trees in the tract. In general, the trees are evaluated with one another in terms of vigor, canopy position, site/species relationship, potential for value increase, potential for loss of the individual, and what could utilize the space. Evaluations are directed at a desired future condition for the tract.

The key is to evaluate the capabilities and limitations of the individual species. For example, the state forests have many even-aged stands of mixed oak. Scarlet oak and black oak, because of their quicker growth are much larger than the white oak. But they also have a much shorter life expectancy, and are now approaching maturity. The white oak is much slower growing, so it is intermediate or suppressed under the black and scarlet oak. White oak is able to respond to release in these situations (based on studies), so it is a reasonable strategy to start the removal of the scarlet and black oak to release the white oak. And the longevity of white oak allows it to be grown to a large size (30"+) and to an age of hundreds of years.

Thinnings and improvements account for the majority of the trees removed in current harvest operations. Thinnings and improvements should release or maintain croptrees. Under typical dense crown conditions, croptrees need to be released on one or two sides to maintain growth. Release on two or three sides is typically needed to increase growth. Rarely is release on all four sides needed, and in many cases it can be detrimental. A rapid change in ring width can make a log unusable for veneer. Or the tree may be more susceptible to wind throw or shock-caused mortality. A consideration is whether a tree is already released from previous management or mortality.

On level ground with canopies at the same height, release of a tree on the south side of its crown provides the most release possible on one side. Release of a tree on the east or west sides of the crown provide a somewhat lower level of release. Release of a tree on the north side of its crown provides the least release. Another consideration is whether the removal of the tree to provide release will damage a croptree. Release may be delayed to avoid damage.

Remember that release strategy varies by aspect and relative crown positions of the trees being evaluated. For example, for a tree on a north-facing slope with tree crowns in the same configuration as the slope position, the removal of the tree just to the south (uphill) will provide much release. The removal of the tree just to the north (downhill) will provide almost no release. On a south-facing slope with the same canopy configuration, the removal of the tree to the south will have little release effect on the croptree.

In summary, evaluate each situation with the goal of removing just enough to maintain or improve the growth of the croptrees. Occasionally croptrees will have sufficient room from previous management release or mortality for maintenance or growth without the need to remove other trees. Also bear in mind that every canopy tree that is not removed and left for some non-timber value (wildlife, aesthetics, etc.) is a croptree for a future cutting cycle. Croptrees can be trees that have low timber value, but provide other value. *It is better to have a good tree in the wrong place than a poor tree in the right place.* In other words, do not sacrifice desired species composition or quality for spacing, as long as the trees remain healthy. However, dense clusters of desirable trees must be thinned to retain vigor. When release is needed, evaluate alternatives from the trees surrounding the desirable trees. With large clusters of desirable trees, it is likely that some of the desirable trees must be removed to provide release to the remaining desirable trees.

Pine Management

Pine management on state forests depends on whether the pine is natural or planted. Natural pine only occurs at Clark State Forest. Most of the state forests have extensive acreage of planted pine on abandoned, eroded fields. Much of this pine is now at maturity or past

maturity.

The natural Virginia pine at Clark State Forest should be managed to maintain its presence and sustainability. The pine that occurs on the steep knobby hills will generally not be subject to management because of the sensitive soils and slopes. The natural pine that is found on more stable sites will be managed similar to hardwoods, grow quality individuals to reach mature condition, and promote sufficient regeneration to maintain the presence of the species.

Non-native pine planted on all state forests should be evaluated on a site-by-site and species-by-species basis. Though not native in most cases, pine does provide benefits to wildlife and has aesthetic value. Any pine stand that is in good condition should be managed to retain and enhance until maturity. This management can include thinning the pine as part of a hardwood operation. Pine stands in poor condition or that have reached maturity should be planned for conversion to hardwoods. This is often done using an even-age method such as clearcutting. Management of pine regeneration in hardwood stands should be evaluated on a case-by-case basis considering the wildlife and aesthetic value of the pine against the species it is competing with. In general, the pines that do well on our state forests are eastern white pine, shortleaf pine, and loblolly pine.

Non-native pine can be planted to reforest old field sites, especially if the conditions are harsh. The recommended species of pine to plant are eastern white pine, shortleaf pine, and loblolly pine. Other species can be planted only if they are mixed with these recommended species. Pine can also be used as a trainer/site ameliorator mixed in hardwood plantings. Pine is also beneficial for some wildlife.

Other Management Considerations

There are numerous non-timber factors beyond the needs of the trees affecting marking decisions. These have to do with the goals for the tract or the forest in general.

Mast production consideration may cause some species to be favored over others for wildlife benefit. Roost and cover can be an important consideration, especially with pine management. Recreational and scenic goals may result in altered management. For example, wolf trees can be very aesthetic. In some areas, wildlife or scenic goals result in the complete exclusion of trees. Some species may be favored simply to maintain their presence to enhance diversity.

Tools

Harvest Operation This is a primary management tool. Our harvest operations generally

combine several silvicultural techniques. Single tree and group selection regeneration are often done in the same operation as improvement and thinning cuts. Occasionally an even-age method such as clearcutting is used to regenerate an area, usually pine-to-hardwood conversion.

With the typical young tracts on state forests, most of the trees harvested are selected because of thinning and improvement treatments. As the tracts mature, the emphasis on thinning and improvement will decrease. An entire harvest, or series of harvests, may mostly consist of group selection openings. This situation would evolve as trees in older openings reached harvestable size and require thinning and improvement treatments.

Timber Stand Improvement (TSI) Another primary management tool, TSI is most often used in post-harvest situations to complete openings and remove culls that logging did not take. More use of this practice should be made in precommercial situations, including pine and to thin pole size stands. Also, group selection openings should be targeted for TSI at age 10-15 years, to perform croptree release on desirable species, especially oak.

There are situations where pre-harvest TSI is desirable. The most striking one is the deadening of grapevines within planned group selection openings. This should occur at least two years prior to harvest if herbicide is not used. Another situation is the deadening of mid story, shade tolerant trees in planned group selection openings in order to promote establishment of advanced oak regeneration. This requires herbicide use to prevent sprouting. It should be done at least two years prior to harvest in order to be present during good seed crop, or immediately after a good seed year before the new seedlings die.

Another TSI situation is follow-up croptree release in 10-year old group selection openings. These are often situations where slower growing species such as oak are being overtopped by faster growing but less desired species such as yellow-poplar. The less desired trees that are competing directly with the desired trees are removed. This increases sunlight to the desired trees, ensuring they will maintain a position in the stand until the next cutting cycle provides another opportunity for release. The less desired species will occupy the areas of the opening between the desired species. This age is also the ideal time to remove vines from the young canopy.

Timber stand improvement is also performed in plantings and plantations. The operations include release, improvement, and thinning treatments, and pruning.

Planting This management tool is used on a more limited basis. The most visible use is the creation of the plantations on some state forests. These are generally pure species plantings on quality, old field sites that receive intensive culture including regular weed control. In order to better deal with microsite variation and other environmental fluctuations, it is recommended that single species plantations are avoided in the future, and plantations consist of two or more species.

There are occasions when reforestation plantings of abandoned fields are necessary, but an intensive plantation is not desired. These plantings should be done with mixed species compositions, and can include pine as a trainer or harsh site ameliorator. Some weed control is necessary in order to get the trees sufficiently established. No planting should be done without sufficient planning for the follow-up treatments to ensure good establishment. After establishment, the planting can be allowed to naturalize.

Occasionally planting in a wooded situation is desired in order to establish oak regeneration. This is done in a situation where a harvest opening will allow the oak to grow and develop. Such enrichment plantings must be planned in advance of the harvest. The seedlings must be planted at least one growing season prior to harvest to ensure good seedling establishment prior to release. All second story trees should be deadened to give the seedlings maximum sunlight.

Second Story Removal This is not a silvicultural operation described in any old textbook, but some recent literature seems to indicate its necessity. This is the removal of the second or mid story, shade tolerant trees present in most state forest stands under the main canopy that prevents the regeneration of the main canopy species, particularly oaks. There are two ways to accomplish this.

The method that can be done most inexpensively and extensively is the use of prescribed fire. This would create the conditions similar to those occurring prior to European settlement when natural fire and Native American fire created park-like conditions in the forest. Botanists with the Division of Nature Preserves feel this was a major factor shaping forest structure and composition. It is believed that oak will become established under the moderate light conditions this would create, while more shade intolerant species would still receive sufficient light for strong growth.

The second method involves using TSI with herbicides to deaden all the target trees. This would be an expensive operation. It would probably be confined to those areas where a harvest is planned within four years, or immediately after an exceptional establishment of oak seedlings. When seedlings are underplanted in planned openings, the undesirable second story trees should be deadened to assist with seedling establishment.

Section Bullet Summary

- Management activity is based on the tract level. Some pine blocks within tracts may be considered separately.
- Hardwood management will consist primarily of uneven-age management.

- Single tree selection, group selection, improvement cutting, and thinnings are generally done in the same operation. Decisions on management methods are based on the condition of the trees in the tract.
- All group selection openings will be evaluated around age 10 years for croptree release through TSI or prescribed fire.
- Pine will be managed to promote growth and quality while it provides wildlife and aesthetic benefits until it reaches maturity. Mature or declining pine stands will be converted to hardwoods.
- Timber management activities will take into account non-timber goals and values.
- Among the management tools available for use are harvesting, timber stand improvement, planting, second story removal, and prescribed fire.